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Mathematics 30

Diploma Examination Results ✓

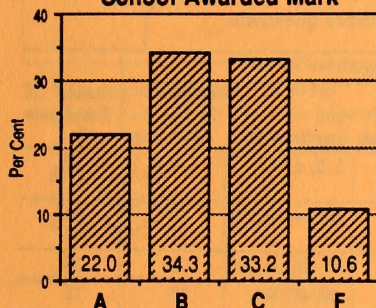
Examiners' Report

January 1992

CANADIANA

APR - 6 1992

School-Awarded Mark

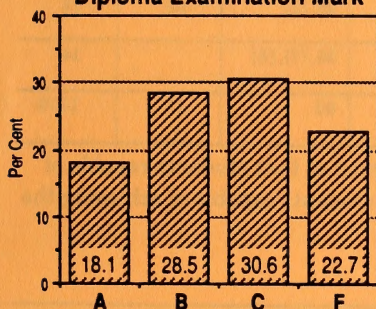


The summary information in this report provides teachers, school administrators, students, and the general public with an overview of results from the January 1992 administration of the Mathematics 30 Diploma Examination. The information is most helpful when used in conjunction with the detailed school and jurisdiction reports that have been mailed to schools and school jurisdiction offices. An annual provincial report containing a detailed analysis of the combined January, June, and August results will be available next fall.

Description of the Examination

The Mathematics 30 Diploma Examination consists of three parts: a multiple-choice section of 40 questions worth 60%, a numerical-response section of 7 questions worth 10%, and a written-response section of four questions worth 30% of the total examination mark.

Diploma Examination Mark

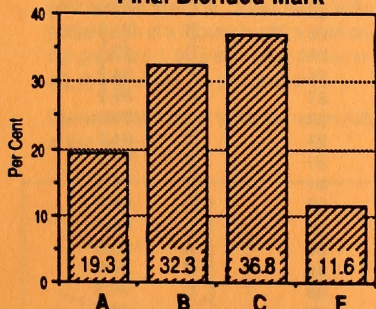


Achievement of Standards

The information reported is based on the final blended marks achieved by 9 233 students who wrote the January 1992 examination.

- 88.4% of these students achieved the acceptable standard (a final blended mark of 50% or higher).
- 19.3% of these students achieved the standard of excellence (a final blended mark of 80% or higher).

Final Blended Mark



Provincial Averages

- The average school-awarded mark was 66.9%.
- The average diploma examination mark was 63.3%.
- The average final blended mark, representing an equal weighting of the school-awarded and diploma examination marks, was 65.5%.

Results and Examiners' Comments

Subtest

When analysing any detailed examination results, please bear in mind that subtest results **cannot** be directly compared.

Results are in average raw scores.

Machine scored: 29.9 out of 47

Written response: 12.4 out of 20

• Course Content

- Polynomial Functions: 4.9 out of 8
- Trigonometric & Circular Functions: 7.7 out of 13
- Statistics: 8.5 out of 13
- Quadratic Relations: 4.8 out of 8
- Exponential & Logarithmic Functions: 5.4 out of 8
- Permutations & Combinations: 5.1 out of 8
- Sequences & Series: 5.9 out of 9

• Cognitive Levels

- Knowledge: 3.1 out of 5
- Comprehension: 10.8 out of 15
- Application: 25.3 out of 40
- Higher Mental Activities: 3.1 out of 7

Examination Blueprint

Each question on the examination is classified in two ways: according to the curricular content area being tested and according to the cognitive level demanded by the question. The examination blueprint illustrates the distribution of questions in January 1992 according to these classifications. Numbers in brackets [] indicate written-response questions, those in parentheses () indicate numerical-response questions, and those without brackets or parentheses indicate multiple-choice questions.

Reporting Category	Questions by Cognitive Level				Exam Emphasis (%)
	Knowledge	Comprehension	Application	Higher Mental Activities	
Polynomial Functions	7	3, 5	1, 2, 4, (1)	6	12
Trigonometric and Circular Functions	8	9, 10, 11	13, 14, (2), [2]	12	19
Statistics	19	15, 16, 20	17, 18, 21, [4]	(3)	19
Quadratic Relations	24	22, 25, 28	23, 26, (4)	27	12
Exponential and Logarithmic Functions	29	30	32, 33, 34, (5)	31, 35	12
Permutations and Combinations		37	36, [1]	(6)	12
Sequences and Series		38, 40	39, (7), [3]		14
Examination Emphasis (%)	7	22	60	11	100%

The examination has a balance of question types and difficulties. It is designed so that students capable of achieving the acceptable standard will obtain a mark of 50% or higher and students capable of achieving the standard of excellence will obtain a mark of 80% or higher.

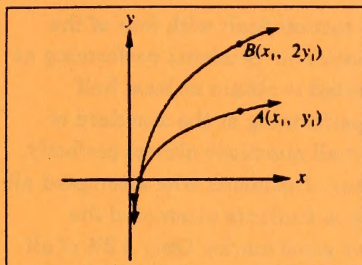
Multiple Choice

For a complete breakdown of student responses by alternative for the multiple-choice questions, please refer to the school and jurisdiction reports.

Students were expected to achieve the acceptable standard on all knowledge and comprehension questions—those questions that required students to apply one concept. Almost all students met this expectation. Students achieving the standard of excellence were expected to demonstrate a thorough knowledge of mathematics and to apply this knowledge to new situations. Questions 6, 12, 27, 31, and 35 required students to apply their knowledge of mathematics to a new situation. An illustrative question follows.

Question	Key	Difficulty*	Question	Key	Difficulty*
1	A	70.5	21	B	81.4
2	B	80.0	22	C	76.4
3	D	66.0	23	C	82.9
4	B	60.4	24	B	71.2
5	D	67.2	25	D	62.5
6	B	56.4	26	C	34.2
7	B	19.5	27	C	36.9
8	B	75.5	28	A	78.0
9	D	80.2	29	D	84.3
10	C	69.1	30	B	77.6
11	C	57.2	31	C	74.5
12	B	41.8	32	D	66.7
13	D	50.6	33	A	84.7
14	A	42.7	34	A	65.6
15	D	73.1	35	C	29.6
16	C	68.2	36	C	79.3
17	A	74.4	37	A	66.3
18	D	58.1	38	A	90.5
19	A	60.0	39	A	77.1
20	B	84.7	40	C	66.0

* Difficulty—percentage of students answering the question correctly



35. In the diagram at the right, A is on the graph of $y = \log_7(x)$ and B is on the graph of

- A. $y = \log_7(2x)$
- B. $y = \log_7(x^{1/2})$
- C. $y = \log_7(x^2)$
- D. $y = (\log_7 x)^2$

Question 35 required students to use the graph of a logarithmic function along with their understanding of logarithmic laws and properties to predict the equation of the curve that contains point B. Students who achieved the acceptable standard are expected to apply their knowledge of the laws and properties of logarithms to evaluate logarithmic expressions and to use the graphs of logarithmic functions to estimate the value of one of the variables, given the other variable. Students who achieve the standard of excellence are expected to be able to draw these two ideas together in order to solve the problem. In fact, only 42.5% of the students who achieved the standard of excellence were able to apply their knowledge of graphs and logarithms by identifying the correct response. Students who achieved the acceptable standard were not able to use the logarithmic laws and incorrectly selected alternative A or B.

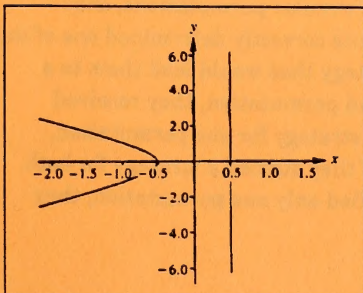
Numerical Response

Question	Key	Difficulty*
1	12	70.5
2	2.3	73.3
3	74	49.3
4	1.5	38.9
5	2.1	53.7
6	80.0	19.7
7	18.0	41.7

* Difficulty—percentage of students answering the question correctly

4. The eccentricity is the ratio of the distance between a point on the graph and the fixed point to the distance between the same point and the fixed line. Shown below is the partial graph of a hyperbola with a point on the graph at $(-\frac{1}{2}, 0)$, a fixed point (focus) at $(-2, 0)$ and a fixed line (directrix) at $x = \frac{1}{2}$.

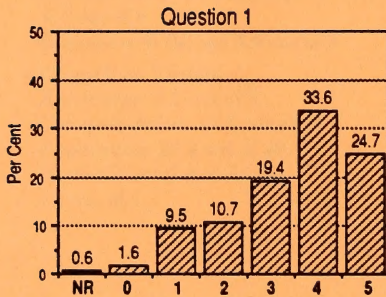
Correct to the nearest tenth, the eccentricity of this conic is ____.



Question 4 required students to calculate the eccentricity of conic, given its fixed line (directrix), its fixed point (focus), and a point on the conic. The definition of eccentricity was provided, as it was expected that all students who met the acceptable standard should be able to describe a conic and calculate its eccentricity, given this information. Only 35.3% of the students who met the acceptable standard and 71.8% of the students who met the standard of excellence were able to read the information presented and calculate the eccentricity that described this conic. Most students who met the acceptable standard apparently assumed from the diagram that the information was about a parabola and so stated that the eccentricity was "1". This is an example of the importance of reading and identifying the information required to solve a problem.

Written Response

Questions in the written-response section dealt with four of the seven content strands for Mathematics 30. Students performing at the acceptable standard were expected to obtain at least half marks on all questions. Students performing at the standard of excellence were expected to answer all questions almost perfectly. We were very pleased at the number of students who attempted all the written-response questions. Once students attempted the questions, they were able to receive some marks. Only 2.3% of all students received no marks for question 1, only 11.3% received no marks for question 2, only 11.1% received no marks for question 3 and only 7.7% received no marks for question 4. This was a considerable improvement over previous years when as high as 47.2% of students failed to receive any marks on a question.



Question 1 required students to determine the number of linear permutations and the number of circular permutations given a situation. They then had to explain why there were more linear permutations than circular permutations. Overall, students did very well on this question. Those who met the acceptable standard were expected to determine the number of permutations and then begin a description in part c. Of students who met the acceptable standard on the examination, 61% met the expectation for this question. Those students who met the standard of excellence were expected to be able to determine the number of permutations and to provide a complete explanation in part c. Of the students who met the standard of excellence, 55.4% met the expectation for this question. On this 5-mark question, the average mark was 3.47 or 69.4% of the available mark.

The Scoring of Question 1: Parts a and b were worth 4 check marks for a total of 3 marks:

Checks	Marks
4	3
3	2
1 or 2	1

Note: If students correctly determined the number of linear permutations and the number of circular permutations, they received 4 check marks. If students correctly determined one of the permutations and started a strategy that would lead them to a reasonable solution for the second permutation, they received 3 check marks. If they started a strategy for one permutation, they received one check mark. If they started a strategy for both permutations or correctly identified only one permutation, they received 2 check marks.

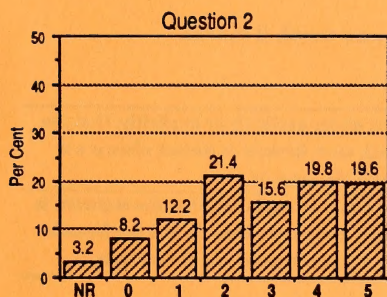
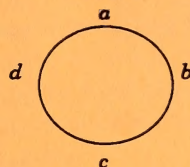
Part c was worth 2 marks. The question explicitly asks students to explain why there are more ways to arrange the 4 cheerleaders in a row than in a circle. A number of students stated that circles have no endpoints, but this statement does not indicate why.

One example of an explanation that would receive 2 marks is:

Four arrangements in a row are related to the same circular arrangement. There is no starting or ending point in a circular arrangement. For example, the four linear permutations

<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
<i>b</i>	<i>c</i>	<i>d</i>	<i>a</i>
<i>c</i>	<i>d</i>	<i>a</i>	<i>b</i>
<i>d</i>	<i>a</i>	<i>b</i>	<i>c</i>

all relate to the same circular permutation:



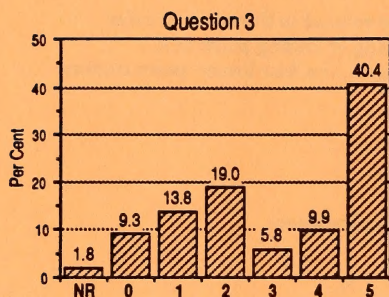
Question 2 required students to comment on the reasonableness of results. This question could have simply asked students to identify the range, amplitude, and period for this trigonometric function. However, the question was asked in the way it was to incorporate aspects of problem solving. Students were required to analyse each of the answers provided, to agree or disagree with them, and to indicate why. They were expected to use the graph in their analysis. Students who met the standard of excellence were expected to obtain at least 4 out of 5 marks on this question. In fact, 84.7% of these students met this expectation. Students who met the acceptable standard were expected to achieve at least 3 out of 5 marks; 57.9% met this expectation. Overall, 60.5% of students who wrote the examination met the acceptable standard for this question. On this 5-mark question, the average mark was 2.79 or 55.8% of the available mark.

The Scoring of Question 2: In order to receive 3 check marks, students needed to state, either explicitly or implicitly, whether they agreed or disagreed with each of Grace's answers. The additional check marks were earned by stating a correct reason.

Checks	Marks
5 or 6	5
4	4
3	3
2	2
1	1

One example of a response that would receive a mark of 5 is:

I disagree with the range because the range should be $-1 \leq y \leq 3$.
The amplitude is 2 not 4. I agree with the period because the graph begins to repeat itself every $\frac{2\pi}{3}$ radians.



Question 3, part a, required students to identify the type of sequence and write an expression to describe its “nth” term. In part b, students were expected to determine a different sequence with the same first and third terms as the sequence in part a. There were an infinite number of solutions for part b. Students who met the acceptable standard were expected to be able to successfully complete part a and to begin a strategy to the solution in part b. Students exceeded these expectations; 40.4% of the students who met the acceptable standard not only successfully completed part a but successfully completed part b as well. Students who met the standard of excellence were expected to be able to successfully complete parts a and b; 85.8% of these students met that expectation. On this 5-mark question, the average mark was 3.11 or 62.2% of the available mark.

The Scoring of Question 3: Part a was worth 2 marks, determined as follows:

2 marks	The student's response indicates, either explicitly or implicitly, that the sequence is geometric and the n th term formula is correct when $a = 6$ and $r = 2$ are both substituted into the formula.
1 mark	The student indicates, either explicitly or implicitly, that the sequence is geometric OR the student provides a n th term formula and the formula describes the sequence when $a = 6$ is substituted into the formula.

One example of a response that would receive 2 marks is:

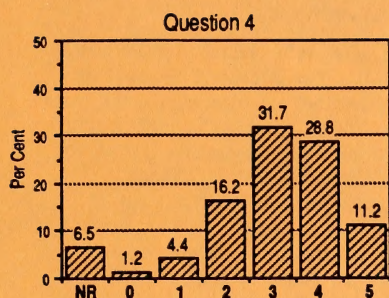
The sequence is geometric with $r = 2$. Then, $t_n = 6(2)^{n-1}$.

Part b was worth 3 marks, determined as follows:

3 marks	The student's expression for t_n gives a first term of 6 and a third term of 24 when $n = 1$ and $n = 3$ are substituted into the expression. The second term of the sequence is shown and can be obtained from t_n when $n = 2$.
2 marks	The student's expression for t_n gives a first term of 6 and a third term of 24 when $n = 1$ and $n = 3$ are substituted into the expression.
1 mark	The student's expression for t_n gives a first term of 6 or a third term of 24 when $n = 1$ and $n = 3$ are substituted into the expression OR student begins a strategy for determining an expression for t_n .

One example of a response that would receive 3 marks is:

The sequence could be arithmetic, geometric, or neither.
If $t_1 = 6$, $2 = 14$, and $t_3 = 24$, then $t_n = (n + 2)^2 + (n - 4)$.



Question 4 required students to develop a strategy toward the solution of a problem. The problem was that the Ice Haven Company wanted to introduce a new frozen dessert. They wanted to do a survey to determine which new frozen dessert would be most popular. Students were asked to provide the Ice Haven Company with a proposal for the survey. Students needed to identify a population, then describe how a sample of the chosen population should be selected and how the survey should be conducted. Students did well on this question. It was expected that students' statements would describe the population, the sampling process, and how the data would be collected. Responses were expected to demonstrate that the students had a sense of reliability, bias, or validity. Students who met the acceptable standard were expected to score at least 3 out of 5 on this question; only 63.3% did so. Students who met the standard of excellence were expected to score at least 4 out of 5 on this question, and 72.2% did so. On this 5-mark question, the average mark was 3.03 or 60.6% of the available mark.

The Scoring of Question 4: A check mark scale was used to score this question:

Checks	Marks
9 or 10	5
7 or 8	4
5 or 6	3
3 or 4	2
1 or 2	1

Students received either 1 or 2 check marks according to the following criteria:

Population	1	The student's response includes the term "population" or implies something larger than the sample.
	2	The student's description of the population includes limiting terms; for example, the population is all people who live in Alberta or Canada, or all students in grades 10, 11, and 12
Sample	1	The student's response indicates, either explicitly or implicitly, that the sample is smaller than the size of the population
	2	Student's description of the sample is consistent with and represents the description of the population.
Method of Selection	1	The student's response describes the type of sampling procedure that will be used, for example, random, convenience, stratified.
	2	The student's response explains the process of selection to match the sampling procedure.
Data Collection	1	The student's response indicates a type of data collection process, for example an interview, a questionnaire, or a taste test.
	2	The student's response describes how or where the data will be collected or what questions will be asked.
Consistency	1	The student's response illustrates a concern for fairness, reliability, validity, bias, or accuracy.
	2	The student's response is workable; that is, the survey as designed could be carried out.

One example of a response that would score a 5 is:

Since not all people like frozen dessert, it is useless to select people randomly on the street and ask what type of dessert he/she likes. The general population probably does not pay attention to the types of dessert available from the Ice Haven Company. Therefore, it is better to choose a sample from people who go to the Ice Haven Company because they like the Company's desserts. Three surveyors would be sent to each company to conduct the survey. Each surveyor will stand beside the cashier and ask every tenth customer that goes to the cashier to order food, "Have you answered the Ice Haven's survey yet?" If the answer is "yes", then wait for the next 'tenth' person. If the answer is "no" then ask the question "What new type of frozen dessert would you like to see on the menu?" When the customer has answered the question, the surveyor will tally the results. The survey will last for a 3 month period in order to get most of the population who buy frozen desserts from the Ice Haven Company. I chose a population that likes desserts. The way that the survey will be conducted prevents biased and inaccurate results because people are chosen randomly and approximately one tenth of the population will be surveyed. The results from the survey should represent the views of the population.

One example of a response that would score a 3 is:

The population will include anybody because most people like dessert and would have a favorite kind. This survey should not be conducted in the winter because people are not interested in frozen desserts when it is cold. The survey could be taken inside a mall where all age groups are represented. The survey should be conducted on the weekend because you will get those people who are not at work or in school. The middle of the afternoon would be the best time since those people who have slept-in may be at the mall.

One example of a response that would score a 1 is:

My proposal is to find some restaurants in different districts in a city. Then I would design a survey sheet to ask the people which type of dessert they like.

For further information, contact Florence Glanfield, Lowell Hackman, or Phill Campbell at the Student Evaluation Branch, 427-2948.